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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Differences in Herbage-Timber Relationships Between Thinned and Unthinned Ponderosa Pine Stands

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Herbage production under a thinned and an adjacent unthinned ponderosa pine stand was compared. Herbage production under the thinned stands was significantly greater than under the unthinned stands for given timber basal areas of less than 70 square feet per acre.

Many herbage-timber relationships have been described for forested areas. Herbage or forage production has been related to crown cover, basal area, or tree litter (Gaines et al. 1954, Pase 1958, Pearson 1964, Halls and Schuster 1965).[2] Such relationships may provide a basis for estimating the amount of herbage to be produced if the timber stocking is reduced (Ffolliott and Worley 1965, Halls and Schuster 1965).

A study was conducted on the Beaver Creek watershed (Worley 1965) in Arizona to determine whether differences existed between herbage-timber relationships on a thinned area and on an adjacent unthinned area.

Study Area

This study was conducted in the ponderosa pine (Pinus ponderosa Lawson) type. Principal grasses and grasslike plants included blue grama (Bouteloua gracilis (H.B.K.) Lag.), sedge (Carex spp.), spike muhly (Muhlenbergia wrightii Vasey), muttongrass (Poa fendleriana (Steud.) Vasey), bottlebrush squirreltail (Sitanion hystrix (Nutt.) J. G. Smith), and black dropseed (Sporobolus interruptus Vasey). The principal forbs and half-shrubs were western ragweed (Ambrosia psilostachya DC.) showy aster (Aster commutatus (Torr & Gray) A. Gray), and broom snakeweed (Gutierrezia sarothrae (Pursh) Britt. & Rusby).

The soils, derived from volcanics (mostly basalt with some cinders), are classified into the Siesta-Sponseller and the Stoneman soil management areas.[3] The distribution of soils

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[2] *Names and dates in parentheses refer to Literature Cited, p. 4.*

[3] *Anderson, T. C., Jr., Williams, J. A., and Crezee, D. B. Soil management report for Beaver Creek watersheds of Coconino National Forest, Region 3. U.S. Forest Serv., 1960, 66 pp. (Mimeographed report on file at Region 3 Office, U.S. Forest Serv., Albuquerque, N. Mex.)*

is similar across the entire study area. There is no measurable difference in herbage production between the soil management areas under similar timber basal areas (Clary et al. 1966).

An area of approximately 2,000 acres was thinned in 1958. This thinning consisted of a commercial timber sale of all mature sawtimber and dwarfmistletoe-infected immature sawtimber, a commercial timber sale of trees 6 to 12 inches d.b.h., and a precommercial thinning of trees less than 6 inches d.b.h. Gambel oak (Quercus gambelii Nutt) was poisoned and alligator juniper (Juniperus deppeana Steud.) was girdled.

The adjacent area for comparison had not been logged for 20 years.

Methods

Six years after thinning, the study areas were sampled to determine possible differences in herbage-timber relationships.

Ninety plots were located in the thinned area and 334 plots in the unthinned area. Herbage production was determined by weight estimate (Pechanec and Pickford 1937) on a 9.6-square-foot plot, and timber basal area was determined by point sampling with a basal area factor of 10 (Grosenbaugh 1952) at each plot.

Timber basal area of the plots on the thinned area ranged from 20 to 150 square feet per acre. Therefore, to develop herbage-timber relationships of equivalent situations, only plots within the same range of basal areas were used from the unthinned area. Ninety plots were used to calculate the herbage-timber relationship on the thinned area, and 279 plots were used from the unthinned area.

Results and Discussion

Herbage production on the thinned area was significantly higher than on the unthinned area at basal areas of less than 70 square feet per acre (table 1). The difference between the slopes of the two regression lines was highly significant (fig. 1). A standard error of the difference between the two curves was calculated following Meyer (1942) except that $\sqrt{2F}$ was used as the confidence coefficient.

Table 1.--Differences in herbage production on thinned and unthinned areas of ponderosa pine under different tree basal areas

Basal area (Sq. ft. per acre)	Herbage production		Difference	$S\sqrt{2F}$ difference	Significance (d = 0.10)
	Thinned	Unthinned			
	Pounds per acre				
20	566.6	376.8	189.8	117.6	*
30	459.9	318.5	141.4	85.1	*
40	384.2	277.1	107.1	64.1	*
60	277.5	218.8	58.7	43.2	*
70	236.9	196.6	40.3	41.3	NS
80	201.8	177.4	24.4	43.0	NS
100	143.0	145.2	-2.2	52.2	NS
120	95.1	119.0	-23.9	63.3	NS
140	54.5	96.8	-42.3	74.1	NS
150	36.3	86.9	-50.6	79.2	NS

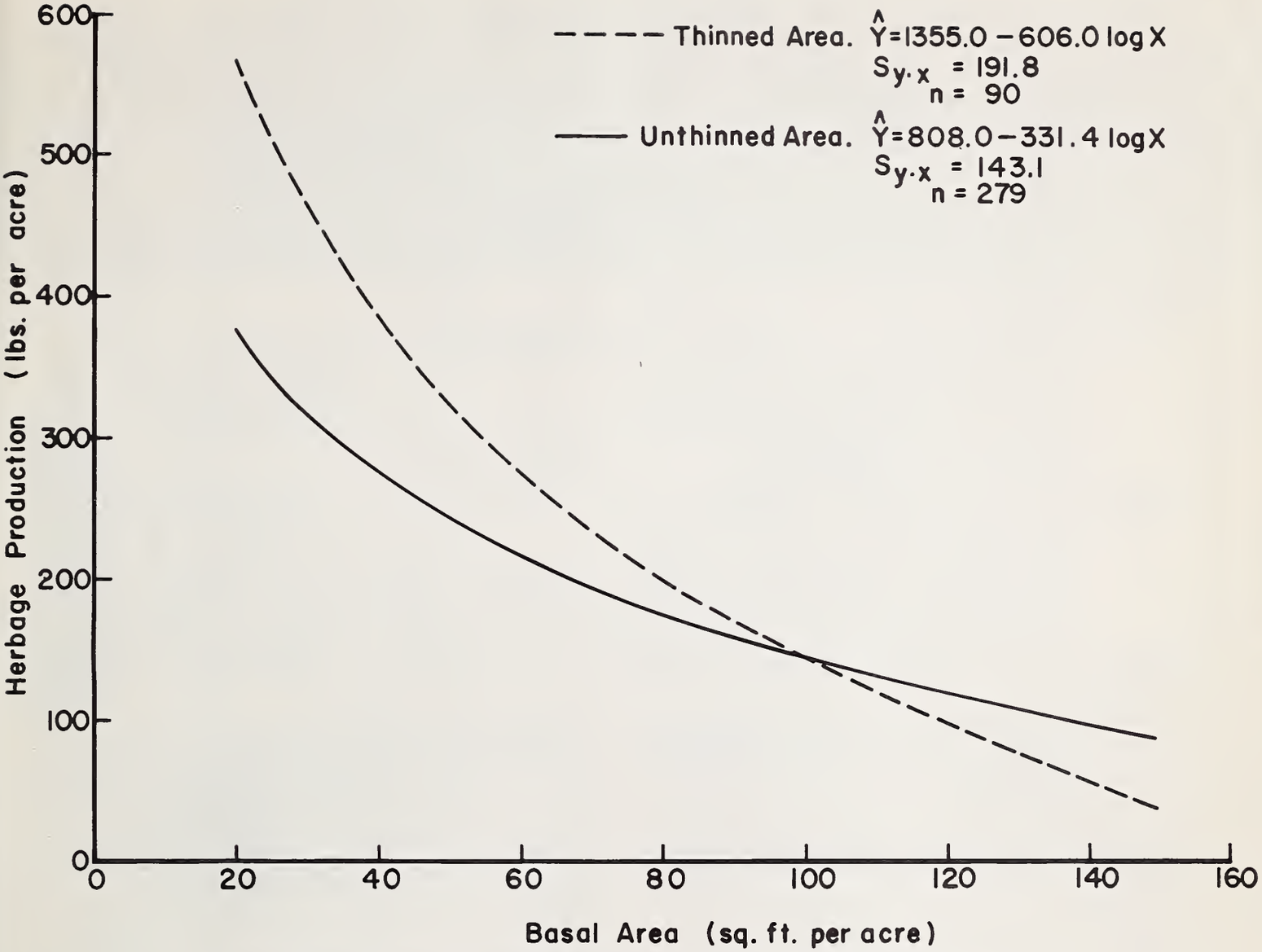

Figure 1.--Relationship between herbage production and timber overstory basal area on thinned and unthinned areas.

The significant differences found indicate that relationships developed on unthinned areas may give low predictions of herbage production on areas thinned to less than 70 square feet basal area.

It is not known whether the difference in the herbage-timber relationships between thinned and unthinned areas is of short duration. If it is a function of stocking arrangement and size class distribution, it may be of a semipermanent nature.

Average production on the thinned area was 257 pounds per acre, while the production on the unthinned area was 157 pounds per acre, a highly significant difference. Herbage composition on the two areas was similar. Timber basal area on the thinned area averaged 72 square feet per acre, while the unthinned area averaged 106.

Conclusions

The thinned area differed from the adjacent unthinned area as follows:

1. The slope of the herbage-timber relationship was significantly steeper.
2. Herbage production for a given basal area was significantly greater for basal areas less than 70 square feet per acre.
3. Average herbage production was significantly higher.

Because relationships from unthinned areas are of questionable value in predicting herbage production to be obtained by thinning, it can be concluded that, when residual timber overstory is reduced, the herbage-timber relationship should be redetermined.

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